

CLAIMS

WHAT IS CLAIMED IS:

1. A flow controlling apparatus comprising:

a rate-based congestion controlling section for adjusting a rate of a sequence of
5 input packets to a value lower than or equal to a prescribed upper limit value for every
flow where the input packets individually belong;

queues provided corresponding to classes to which said input packets can belong,
for storing and sending said input packets according to first-in first-out;

a queue monitoring section for identifying, from said queues, a queue wherein
10 an amount of information in a stored packet exceeds a prescribed threshold value; and

a buffer managing section for discarding new packets at a predetermined
frequency in every flow to which the new packets belong, said new packet whose rate is
adjusted by said rate-based congestion controlling section and being to be stored in said
identified queue.

2. The flow controlling apparatus according to claim 1, wherein

said buffer managing section for identifying a flow to which an input packet
belongs comprises

a section which is integral with/provided in said rate-based congestion
controlling section.

3. The flow controlling apparatus according to claim 1, further comprising

a rate monitoring section for monitoring said rate of said sequence for every flow,
and wherein

said buffer managing section stores said rate-adjusted packet at a frequency in
one of said queues corresponding to classes of said rate-adjusted packet, the frequency
25 being an equivalent of a proportion of said monitored rate in each class to a total of said

monitored rates in all the classes, or an equivalent of a proportion as an increasing function of the proportion of said monitored rate in each class.

4. The flow controlling apparatus according to claim 2, further comprising a rate monitoring section for monitoring said rate of said sequence for every flow,

5 and wherein

said buffer managing section stores said rate-adjusted packet at a frequency in one of said queues corresponding to classes of said rate-adjusted packet, the frequency being an equivalent of a proportion of said monitored rate in each class to a total of said monitored rates in all the classes, or an equivalent of a proportion as an increasing function of the proportion of said monitored rate in each class.

5. The flow controlling apparatus according to claim 1, wherein

said buffer managing section records a past result of packet discard for every flow, and performs one of:

excluding a new packet of a flow having said past result from being a subject of discarding; and

discarding said new packet at a lower frequency than a frequency at which new packets of a flow not having said past result are to be discarded.

6. The flow controlling apparatus according to claim 1, wherein

said buffer managing section counts the number of times packet(s) is/are discarded for every flow, and performs one of:

excluding, from a subject of discarding, a new packet of a flow where packet(s) is/are discarded a number of times greater than or equal to a prescribed value; and

discarding said new packet at a lower frequency than a frequency at which new packets of a flow where packet(s) is/are discarded a number of times smaller than said prescribed value, are to be discarded.

7. The flow controlling apparatus according to claim 5, wherein
said buffer managing section keeps a past result of packet discard for every flow
to which the discarded packets belong, and performs one of:

excluding, from a subject of discarding, a packet which belongs to a flow whose
5 past result is kept and which is to be stored in said queue identified by said queue
monitoring section; and

discarding said packet to be stored at a lower frequency than a frequency at
which new packets of a flow not having said past result are to be discarded.

8. The flow controlling apparatus according to claim 6, wherein
said buffer managing section keeps the number of times packet(s) is/are
discarded for every flow, and performs one of:

excluding, from a subject of discarding, a packet which belongs to a flow where
packet(s) is/are discarded a number of times greater than a predetermined value and is to
be stored in said identified queue; and

discarding said packet to be stored at a lower frequency than a frequency at
which packets belonging to a flow where packet(s) is/are discarded a number of times
smaller than said predetermined value, are to be discarded.

9. The flow controlling apparatus according to claim 6, wherein
said buffer managing section keeps a number of times packet(s) is/are discarded,
20 whose importance of the kept data is weighed lighter as time elapses, the number being
kept corresponding to a flow to which said packet belongs, and performs one of:

excluding, from a subject of discarding, a packet of a flow whose number of times
packet(s) is/are discarded is kept, and is to be stored in said identified queue; and

discarding said packet to be stored at a frequency which is lower, the smaller said
25 number of times said packet is discarded becomes.

10. The flow controlling apparatus according to claim 1, wherein:

said queue monitoring section identifies a degree in which said amount of information in packets stored in said queues exceeds said prescribed threshold value; and

said buffer managing section discards new packets to be stored in said queue at a frequency which is higher, the higher said identified degree is.

11. The flow controlling apparatus according to claim 1, wherein said buffer managing section:

is given in advance a maximum value conforming to said classes respectively corresponding to said queues; and

discards new packets of said classes at a frequency lower than or equal to said maximum value.

12. The flow controlling apparatus according to claim 1, wherein said buffer managing section:

is given in advance, for every flow, a number, which is the maximum of the number of new packets allowed to be discarded, the packets being in a range of transmission bandwidth to be secured; and

refrains from discarding a new packet, subsequent to new packets of a maximum number, after said maximum number of new packets are discarded.

13. The flow controlling apparatus according to claim 1, further comprising

a transmission bandwidth monitoring section for recognizing a maximum transmission bandwidth to be secured for each of said classes respectively corresponding to said queues, and wherein

said buffer managing section:

is given in advance, for every flow, a number, which is the maximum of the number of new packets allowed to be discarded, the packets being in a range of

transmission bandwidth to be recognized by said transmission bandwidth monitoring section; and

refrains from discarding a new packet, subsequent to new packets of a number greater than or equal to the maximum number, after the number greater than or equal to said maximum number of new packets are discarded.

14. The flow controlling apparatus according to claim 1, wherein said buffer managing section:

is given a reference value conforming to a transmission bandwidth to be secured for each of possible flows and classes to which a packet to be stored in said queue identified by said queue monitoring section belongs; and

refrains from discarding a new packet, subsequent to new packets having a difference and a ratio greater than or equal to said reference value, after the difference or the ratio between a sum of the numbers or amount of information in packets becomes greater than or equal to said reference value, said packets being previously discarded packets and not discarded packets.

15. The flow controlling apparatus according to claim 1, wherein said buffer managing section discards said new packet in every flow at a frequency that is lower in order of time-series.

16. The flow controlling apparatus according to claim 1, wherein said buffer managing section discards new packets at a frequency which is higher, the greater a proportion becomes when a dispersion of the proportion is smaller than a predetermined threshold value, the proportion being the number of discarded packets in each class to the total number of discarded packets in all the classes.

17. A node apparatus comprising:
a flow controlling apparatus comprising

a rate-based congestion controlling section for adjusting a rate of a sequence of input packets to a value lower than or equal to a prescribed upper limit value for every flow where the packets individually belong,

queues provided corresponding to classes to which said input packets can belong, for storing and sending said packets according to first-in first-out,

a queue monitoring section for identifying, from said queues, a queue wherein an amount of information in stored packets exceeds a prescribed threshold value, and

a buffer managing section for discarding new packets at a predetermined frequency in every flow to which the new packets belong, said new packets whose rate is adjusted by said rate-based congestion controlling section and being to be stored in said identified queue; and

communication interfacing section for sending a packet stored in said queue, to a predetermined link or terminal.